are not surprised to find no reference to the "thinking horses" of Elberfeld. There are effective illustrations, and the printing of both books is such as suits both young and old eyes.

(3) Mr. Dixon has the courage of his anthropomorphism, which is of the deepest dye. For he maintains that plants "see, hear, taste, feel, walk, swim, run, fly, jump, skip, hop, roll, tumble, set traps, and catch fish; decorate themselves that they may attract attention; powder their faces; imitate birds, animals, serpents, stones; play hide and seek; blossom underground; protect their children, and send them forth into the world prepared to care for themselves—indeed, do all those things which we ourselves do. We now know that plants have even minds and souls, with which to think and to worship."

This is partly a rebound from a *hortus siccus* botany, partly an uncritical vitalism, and partly a somewhat saddening illustration of the lack of critical balance. Saddening, we call it, because the author has a fine series of most interesting facts to set forth concerning the intense vitality of plants, their movements, their sensitiveness, their adaptations, and their purposiveness (we do not say purposefulness), and yet he has gone and queered his pitch with an intolerably anthropomorphic and sentimental phrasing.

No one can be very enthusiastic over the botanist's terminology of chemotaxis, heliotropism, nyctinastic movements, and the like, but there should be some middle way between this and talking, as Mr. Dixon does, about the activities of plants as if they were on a plane with our own. We do not blame the author for regarding plants as psycho-physical beings—which seems to us a position which can offer a strong defence—nor even for speaking, if he wishes, about their senses (seven in number) and experiments, their "mentality and spirituality"; we blame him for leading the unwary to think that plants tackle the business of life on anything like human lines. For this will have to be unlearnt. Theirs is certainly *another way*, even farther from our understanding than instinct is.

TEXT-BOOKS OF PHYSICS.

(1) *Elements of Optics for the Use of Schools and Colleges.* By G. W. Parker. Pp. iv+122. (London: Longmans, Green and Co., 1915.) Price 2*s.* 6*d.*

(2) *Elementary Experimental Statics.* By I. B. Hart. Pp. vii+200. (London and Toronto: J. M. Dent and Sons, Ltd., 1915.) Price 2*s.* 6*d.*

(3) *Introduction to Heat.* By A. R. Laws and P. W. Todd. Pp. x+212. (London: Mills and Boon, Ltd., 1915.) Price 2*s.* 6*d.*

(4) *Experimental Harmonic Motion: a Manual for the Laboratory.* By Dr. F. G. C. Searle. Pp. x+92. (Cambridge: At the University Press, 1915.) Price 4*s.* 6*d.* net.

(1) IN Mr. Parker's "Elements of Optics" the subjects of reflection, refraction, mirrors and lenses, simple optical instruments, and dispersion are dealt with in four chapters. The book is intended for beginners, and no further mathematical knowledge is required for its perusal than an acquaintance with elementary geometry, simple algebraic equations, and the trigonometrical ratios. The text consists chiefly in the derivation of the usual formulæ of geometrical optics, the deviation method being employed for mirrors and lenses. The statements are accurate and concise, and the diagrams clear. Many teachers will regard the book as being too sparse and somewhat uninteresting owing to the absence of experimental matter. The inclusion of experiments to verify the laws and results by the aid of simple and inexpensive apparatus, would have enhanced the value of the book considerably. Numerical exercises are interspersed in the text, and answers are supplied.

(2) "Elementary Experimental Statics," by Mr. Ivor B. Hart, is written for pupils beginning the subject of mechanics. The mathematical knowledge assumed does not extend beyond an acquaintance with simple algebraic equations. The author deals with parallel forces, centres of gravity, inclined forces, friction, and the simple machines. The chief elementary facts are impressed on the pupil by a series of simple experiments. Full directions for the performance of these experiments are given, and the method of recording the results is indicated. It is better to insist on the tabulation of actual observations than results obtained after a mental calculation, as in col. 5 of the table on p. 45. The book is provided with a large number of questions and numerical exercises. The pupil who performs the experiments and works the examples in this book will have laid a good foundation for further study in experimental science.

(3) "Introduction to Heat," by Messrs. Laws and Todd, may be used both as a class and laboratory text-book in schools. The aim of the authors has been to introduce many phenomena from everyday life, and by appealing to the ordinary experiences of the pupil to awaken an intelligent interest in the subject. The order of treatment is somewhat different from that usually adopted in text-books of this character. The opening chapter

© 1915 Nature Publishing Group

deals with conduction and convection of heat, and this is possible because at such a stage only a descriptive treatment of these subjects can be attempted. Other sections of the book deal with the barometer and thermometer, expansion, evaporation and condensation, hygrometry, fusion and solidification, specific heat, radiation, heat and work. Certain paragraphs are to be omitted on first reading.

Speaking generally, the authors have succeeded in producing an interesting text-book, but in many places the statements are loose and not characterised by that precision of language which it is so essential to inculcate in the mind of a beginner. Thus on p. 19 the authors speak of the pressure due to 60 c.c. of water, and on p. 88 define the British unit of heat as "the quantity of heat required to raise 1 lb. of water 1° F." This omission of "the temperature of" is a common occurrence in the text. Again on p. 20 we have an experiment "To determine how much 1 c.c. of air expands when heated." In this the temperature of 160 c.c. of air is raised from 15° C. to 85° C., the amount of expansion being 40 c.c. The calculated expansion of 1 c.c. is $40/(160 \times 70) = 1/280$. The authors then state: "an accurate and at the same time convenient result is 1/273." On p. 140 paraffin-wax is not a suitable material to illustrate melting point by the curve of cooling. In the diagram on p. 40 the pressure gauge should be connected to the inner cylinder of the hypsometer. The book contains a large number of questions and numerical exercises.

(4) Dr. Searle's "Experimental Harmonic Motion" is written on lines very similar to his well-known manual on "Experimental Elasticity." The subject-matter dealt with, however, is not so wide as the title would seem to imply. The first part of the book is devoted to the elementary theory of harmonic motion, and is apparently carried only so far as is necessary to understand the experiments described in the second chapter. There is no discussion of damped vibrations, composition of harmonic motions, or the analysis of periodic curves. The experiments described in the second chapter (fourteen in number) are such as are performed in the author's classes at the Cavendish Laboratory. They include oscillation methods for comparing moments of inertia, determinations of the acceleration due to gravity, the experimental study of a pendulum with yielding support, and an investigation of a system with two degrees of freedom. A theoretical discussion of each experiment is given, and there are full practical details for the design of the apparatus to ensure satisfactory results. Each experiment is furnished with a typical series of data obtained in an actual experiment. The exposition is clear, and the book may be profitably read by university students. Many teachers will welcome a book of this kind on account of the precise details for the setting up of the various experiments.

LABORATORY WORK ON COAL AND COAL-PRODUCTS.

Laboratory Work for Coal-mining Students. By J. Sim and A. M. Wylie. Pp. viii+136. (London: E. Arnold, 1915.) Price 2*s.* 6*d.* net.

THE difficulties associated with coal analysis are determined in part by the fact that a material which is consumed in tons has for convenience of manipulation to be tested in grams, and in part by the variety of uses to which coal is applied. The first necessitates merely extreme care and method in sampling, but the second requires a diversity of tests demanding the greatest skill and experience. The most satisfactory way of conducting a test is obviously to submit a large sample of the material to the special process to which it is subsequently to be applied. This is frequently done; but it is not described in the present volume, which is concerned with laboratory methods only.

The difficulties attending coal analysis may be realised when one considers the variety in composition as well as the chemical sensitiveness of the substance. Coal is no sooner exposed to the air than it begins, especially when in powder, to absorb oxygen and to evolve carbon monoxide and dioxide. The sulphur which is present, partly as organic sulphur and partly as pyrites, also undergoes oxidation. Then, again, the nature of the products and by-products, upon which its value in the gas and coking industry depends, is determined by the character of the coal as well as by the temperature at which these products are extracted or distilled. For example, it has been shown recently that extraction with pyridine removes considerable quantities of paraffins, that distillation *in vacuo* gives rise to a series of naphthenes (cycloparaffins), whilst ordinary destructive distillation at high temperatures produces the coal-tar hydrocarbons. It would appear from this that the original hydrocarbon of the coal passes through various stages in the process of heating. Finally, a knowledge of the thermal value of the coal when used as fuel is essential. It will be seen that the investigation of a sample of coal is not a simple affair.

The present volume has been written with the object of facilitating the laboratory work of a coal-mining student, that is, one who is studying the scientific basis of the industry from every point

© 1915 Nature Publishing Group